



THE DEPARTMENT OF THE NAVY'S INFORMATION TECHNOLOGY MAGAZINE

[Notify Me of New Issue](#)[CURRENT ISSUE](#)[BACK ISSUES](#)[AUTHOR INDEX](#)[BROWSE TAGS](#)[ABOUT CHIPS](#)[GO](#)[Email](#)

The Evolution of Infrastructure

By Thomas Kidd - January-March 2017

All roads lead to Rome. Since ancient times, infrastructure has been the keystone to civilization. At its core, infrastructure is transportation. Infrastructure transports people, clean water, food, and power into our lives and infrastructure transports sewage and garbage safely away. Modern civilizations are the result of infrastructure development. How has infrastructure evolved, and what could it encompass in the future?

Innovations in infrastructure are typically built alongside, or integrated into, existing infrastructure. Transportation was first built on the natural infrastructure of rivers. Roads soon followed. Sewage and clean water systems were often built under roads. In addition, in the 20th century, infrastructure expanded to encompass electricity and telecommunications grids.

Most infrastructure is built on a hub-spoke architecture. Paths went to and from the village. Roads went from the villages to the city. Few infrastructures are truly point-to-point. In the 20th century, every house had a telephone wire connecting it to a switching hub which then connected to other houses. The same is true for modern wireless communications network design. Today, cellular networks are still built around this hub-spoke architecture but without a dedicated physical line to each device.

While infrastructure is the foundation on which human civilization is built, it is also the vulnerability by which many have fallen. Without a reliable infrastructure, civilizations cannot endure. This is true for military infrastructure, as well as civil.

For a mobile military, maintaining its internal infrastructure while integrating into coalition and a host nation's infrastructure is an exceptionally complex challenge. A modern carrier strike group is comparable to a mobile floating city with several airports. Each ship is a village with power, sewage, and communications requirements. Nearly all of these services depend on electricity.

In addition to obvious uses, such as light, heat, and communications, many other electrical systems may not be so apparent. Large ships operate much the same way a diesel locomotive uses its diesel engine to drive a generator and produce electricity which then powers an electric motor to turn the propellers. Even advanced nuclear-powered submarines and aircraft carriers are, at their core, electric vehicles.

It is hard to imagine a world without electricity. Brief interruptions in electrical power can send a city into turmoil. Long-term power disruption, for months or years, is the stuff of post-apocalyptic novels.

For deployed military, and particularly ships at sea, our modern land-based electrical infrastructure, the power grid, is inaccessible. Power must be generated locally. Moreover, as a result, fuel for power production must be transported across oceans and hostile areas to where the power is produced to support our Sailors and Marines.

Futurists speculate this may change by the middle of the 21st century. Along with high efficient solar and wind systems, it will also be practical to transmit power wirelessly. Similar to satellite communications, begun in the mid-20th century, satellite power distribution may become reality in the mid-21st century.

Combining wireless power transmission with ultra-high efficient batteries and capacitor-based storage will reduce, and in many cases, eliminate, the cost and challenge of transporting fuel to produce electricity.

Wireless power infrastructure will prove to be a radical transformation. Similar to the current wireless telecommunication revolution, the traditional power grid infrastructure will be simultaneously challenged and enhanced by dynamic wireless solutions. Strings of power poles and high tension power lines dotting the landscape may become a rare sight.

Global access to electricity will enable migration to new geographic areas, reducing population concentrations and related congestion. The ability to deliver power without costly and complicated

Related CHIPS Articles

[Deputy Secretary Discusses Future of Space Force at Space and Missile Systems Center](#)

[ICYMI: Artificial intelligence likely to help shape future battlefield, says Army vice chief](#)

[Junior Navy Technologists Create Autonomous Swarm Capability for Warfighters](#)

[Navy awards Boeing \\$805.3 million contract to design, build MQ-25A Stingray](#)

[Royal Australian Navy Delegation Visits NSWDC Dahlgren Division in the Wake of RIMPAC 2018](#)

Related DON CIO News

[DON CIO Remains Focused on DON IM/IT policy and Governance Oversight](#)

[DON IT Conference Presentations Available](#)

[SECNAV Instruction 2400.2A Provides Updated DON Policy on Electromagnetic Environment Policy and Management](#)

[DON IT Conferences Share Information / Recognize DON IT Award Winners](#)

[DON CIO Publishes Cyber Glossary](#)

Related DON CIO Policy

[Electromagnetic Environmental Effects and Space Weather Event Preparedness Policy and Management](#)

[Radio Receiver Frequency Assignments for Mission-Critical Systems](#)

[DON Electromagnetic Spectrum Harmful Interference Reporting](#)

[Spectrum Supportability Risk Assessment Process Using the Spectrum Supportability Integrated Process Portal](#)

[DON Cyberspace IT and Cybersecurity Workforce Management and Qualification Manual](#)

infrastructure will be an advantage to the nearly 2 billion people currently living without electricity. In time, this technology will also enhance Navy and Marine Corps operations.

As with each advance in infrastructure, wireless power infrastructure will open new opportunities for human civilization.

Tom Kidd is the Director for DON Strategic Spectrum Policy for the [Department of the Navy Chief Information Officer](#).

TAGS: [Cybersecurity](#), [NEN](#), [NNE](#), [Spectrum](#), [Telecommunications](#), [Wireless](#), [Workforce](#)

CHIPS is an official U.S. Navy website sponsored by the Department of the Navy (DON) Chief Information Officer, the Department of Defense Enterprise Software Initiative (ESI) and the DON's ESI Software Product Manager Team at Space and Naval Warfare Systems Center Pacific.

Online ISSN 2154-1779; Print ISSN 1047-9988
Hyperlink Disclaimer